

Ambulatory Glucose Profile (AGP) report in daily care of patients with diabetes: practical tips and recommendations

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Case study 1: Patient profile

Patient 1	Current diabetes therapy
Age: 41 years Gender: Male Type of diabetes: 1 Duration of diabetes: 20 years BMI: 22.5 kg/m ² (1.76 m; 68 kg) Latest HbA1c result: 6.6 % (49 mmol/mol)	Current diabetes therapy • Intensive insulin therapy: – Long-acting analogue - 14 Units – Fast-acting analogue - Breakfast 1.5 Units/10g CHO – Other meals 1 Unit/10g CHO – Target premeal glycaemia 100 mg/dL – Correction dose = 1 Unit insulin per 40 mg/dL. – Physical activity: Almost daily cycling 20-50 km. • Comorbid diseases: – Hashimoto's disease (euthyroidism) • Other medications taken: – L-thyroxin

CHO, carbohydrate

Case study 1: AGP Report

AGP Report

8 January 2021 - 21 January 2021 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

8 January 2021 - 21 January 2021

14 Days

% Time Sensor is Active

86%

Ranges And Targets For		Type 1 or Type 2 Diabetes
Glucose Ranges	Targets % of Readings (Time/Day)	
Target Range 70-180 mg/dL	Greater than 70% (16h 48min)	
Below 70 mg/dL	Less than 4% (58min)	
Below 54 mg/dL	Less than 1% (14min)	
Below 180 mg/dL	Less than 25% (6h)	
Below 250 mg/dL	Less than 5% (1h 12min)	
Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.		

Average Glucose

143 mg/dL

Glucose Management Indicator (GMI)

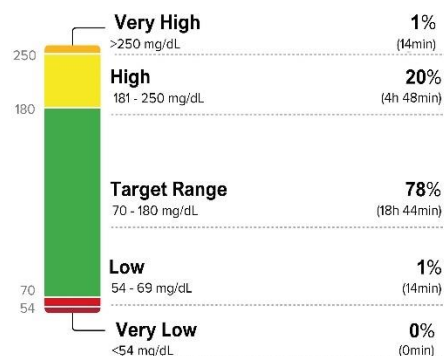
6.7% or 50 mmol/mol

Glucose Variability

30.7%

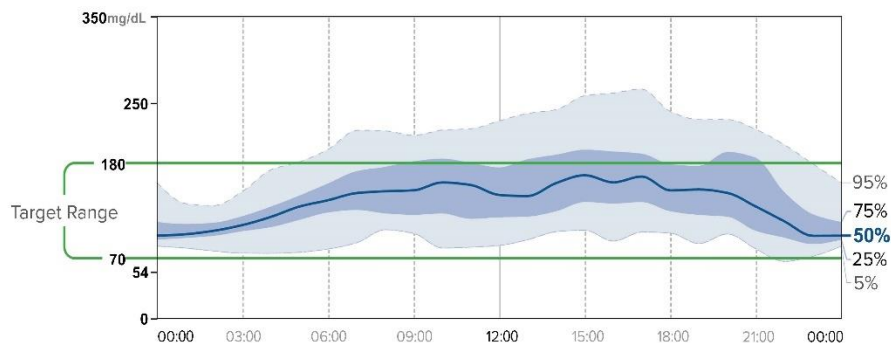
Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES



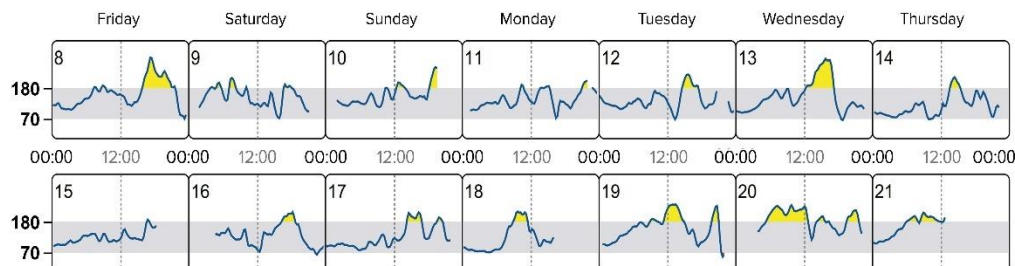
AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



DAILY GLUCOSE PROFILES

Each daily profile represents a midnight to midnight period with the date displayed in the top-left corner.



Source: Battelino, Tadej, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American Diabetes Association, 7 June 2019, <https://doi.org/10.2337/doi19-0028>.

Case study 1: Interpretation and recommendations

ISSUE:	
Quality of data captured by the CGM system	86% sensor activity time, 14-day analysis period. Sufficient to adequately assess glycaemic control indices
Percentage of time in each target range	In line with targets for this patient group TIR = 78%; TBR 54-69 mg/dL = 1%; TBR <54 mg/dL = 0%; TAR 181-250 mg/dL = 20%; TAR >250 mg/dL = 1%
Glycaemic data	Mean glucose = 143 mg/dL; GMI = 6.7%
Glycaemic variability	Normal value (CV 30.7% versus target $\leq 36\%$)
IDENTIFY CLINICAL PROBLEM AND OFFER SOLUTION TO PATIENT	
Hypoglycaemia	The first half of the night, between 21.30 and 23.00
High glycaemic variability	Greater during the day than at night, with relative stability at night, wide bands of variability during the day
Hyperglycaemia	Mainly afternoon and early-evening hours
RECOMMENDATIONS/COMMENTS: The patient administers a fast-acting analogue, regardless of glycaemia, directly before the meal and usually underestimates his bolus dose because of fear of hypoglycaemia. He associates hypoglycaemic episodes with episodes of increased physical activity. Typically, he takes physical activity 90-120 minutes after a meal, reducing his calculated bolus dose before a meal by 40-50%. The wide 5-95% percentile band in the AGP profile indicates that behavioural factors are the main reason for the wide dispersion of results. An additional report is available in LibreView – the "Snapshot", which indicates that the patient is performing 7 scans per day - he is recommended to increase the scanning activity, which is especially important with a dynamic lifestyle. Together with the patient, a switch from rapid-acting to ultra-rapid acting analogue was agreed with the patient. Training was provided on how to adjust the dosage of insulin and carbohydrate intake to match the body's needs before, during, and after the physical exercise. The patient will establish a regular exercise time and assess whether it affects the tendency to repeated hypoglycaemia in the evening.	

All case studies have been created for illustration purposes based on real-world scenarios. No actual patient information is presented.

Case study 2: Patient profile

Patient 2	Current diabetes therapy
Age: 14 years Gender: Female Type of diabetes: 1 Duration of diabetes: 9 years BMI: 21 kg/m ² Last HbA1c result: 7.4% (57 mmol/mol)	– Insulin pump therapy: – Ultra fast-acting analogue – Basal rate: basal rate (U/h): 0-1:0.5; 2:0.55; 3:0.6; 4-7:0.65; 8:0.6; 9:0.55; 10-14:0.5; 15-21:-0.55; 22-23:0.5 (13.35Units/24h) – ICR: 0:8g CHO/1U, 6:11g CHO/1U; 9.30:9g CHO/1U; 11.30: 8g CHO/1U; 15.00:8g CHO/1U; 17.30:9g CHO/1U; 20.00: 8g CHO/1U • Comorbid diseases: – Hashimoto's disease (euthyroidism) – Screening for celiac disease every two years negative • Other medications taken: – L-thyroxin

Case study 2: AGP Report

AGP Report

17 May 2021 - 30 May 2021 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

17 May 2021 - 30 May 2021

14 Days

% Time Sensor is Active

98%

Ranges And Targets For		Type 1 or Type 2 Diabetes
Glucose Ranges	Targets	% of Readings (Time/Day)
Target Range 70-180 mg/dL	Greater than 70% (16h 48min)	
Below 70 mg/dL	Less than 4% (58min)	
Below 54 mg/dL	Less than 1% (14min)	
Below 180 mg/dL	Less than 25% (6h)	
Below 250 mg/dL	Less than 5% (1h 12min)	

Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.

Average Glucose

158 mg/dL

Glucose Management Indicator (GMI)

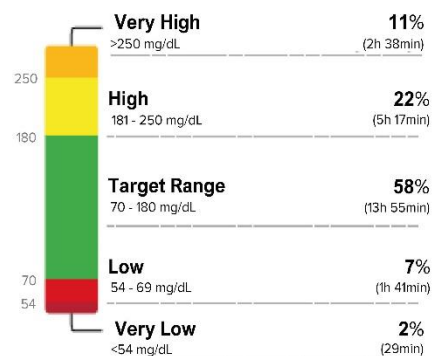
7.1% or 54 mmol/mol

Glucose Variability

42.9%

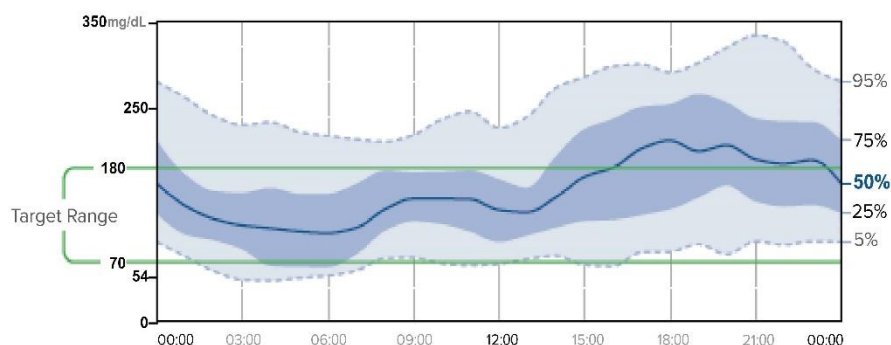
Defined as percent coefficient of variation (%CV); target $\leq 36\%$

TIME IN RANGES



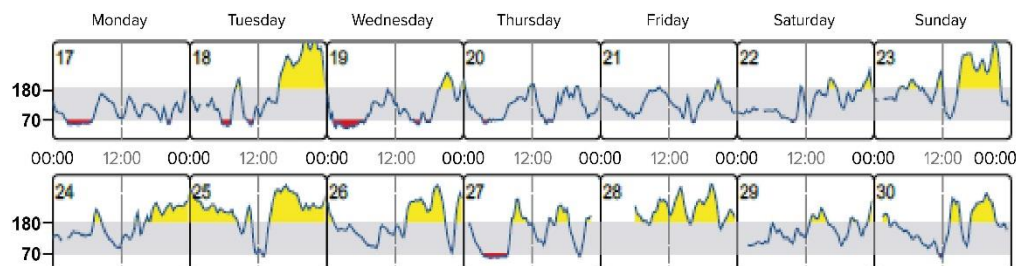
AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



DAILY GLUCOSE PROFILES

Each daily profile represents a midnight to midnight period with the date displayed in the top-left corner.



Source: Battelino, Tadej, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American Diabetes Association, 7 June 2019, <https://doi.org/10.2337/dci19-0028>.

Case study 2: Interpretation and recommendations

ISSUE:	
Quality of data captured by the CGM system	98% sensor activity time, 14-day analysis period Sufficient to adequately assess glycaemic control indices
Percentage of time in each target range	All metrics not consistent with the targets for this patient group TIR = 58%; TBR 54-69 mg/dL = 7%; TBR <54 mg/dL = 2%, TAR 181-250 mg/dL = 22%; TAR > 250 mg/dL = 11%
Glycaemic data	Unsatisfactory glycaemic control: Mean glucose values too high = 158 mg/dL; GMI = 7.1%
Glycaemic variability	Too much variation (%CV = 43.1% versus target ≤ 36%)
IDENTIFY CLINICAL PROBLEM AND OFFER SOLUTION TO PATIENT	
Hypoglycaemia	Several hours of hypoglycaemia during the night, for 4 consecutive nights; 4 episodes of hypoglycaemia early afternoon, including 3 on consecutive days, then improvement
High glycaemic variability	Too much variability in glucose, especially in the afternoon. Patient has no malabsorption risk factor (negative screening for celiac disease), so consider other issues.
Hyperglycaemia	Episodes of hyperglycaemia occur frequently in the afternoon, but the report shows that they are not every day; wide 5th -95th percentile band and persistent hyperglycaemia for several hours may indicate behavioural problems: irregular insulin pump infusion set changes, lack of correction boluses, wrong calculation of carbohydrate amounts in meals
RECOMMENDATIONS/COMMENTS: Hypoglycaemic episodes of several hours during the night requires consideration - whether it was actually night-time hypoglycaemia or possibly due to another reason, for example, due to pressure on the sensor during sleep. Such episodes are worth verifying with a glucometer. If hypoglycaemia is confirmed, it is necessary to reduce the dose of insulin. The CGM recorded 4 episodes of hypoglycaemia in the early afternoon, including 3 on consecutive days. Possible causes were a change in lifestyle or a greater physical effort than usual. Hypoglycaemia was not recorded on consecutive days, which may result from the patient's correct reaction to previous hypoglycaemia by e.g. reduction of insulin dose.	

Hyperglycaemia is observed relatively frequently, but not daily in the afternoon or evening. Significant hyperglycaemia persisting for several hours with a wide 5th - 95th percentile band indicates behavioural issues: irregular change of infusion sets, no correction boluses, wrong calculation of carbohydrate amounts in meals.

After a few days with good results, there are a few more days with persistent hyperglycaemia for a significant percentage of time - has there been a change in lifestyle for these days, e.g. due to menstrual period, illness?

In summary, in the first stage, it is necessary to assess the weekly schedule of school and extra-curricular activities, taking into account weekend differences. Also, analyse the patient's behaviour and her compliance with therapeutic recommendations. In the second stage, after establishing the causes of the hypoglycaemia, aim to eliminate them. The third step should focus on resolving hyperglycaemia.

All case studies have been created for illustration purposes based on real-world scenarios. No actual patient information is presented.

Case study 3: Patient profile

Patient 3	Current diabetes therapy
Age: 69 years Gender: Male Type of diabetes: 2 Duration of diabetes: 20 years BMI: 31.5 kg/m² Last HbA1c score: 7.5 % (58mmol/mol)	Current diabetes therapy • Multiple daily injection (MDI) insulin therapy: – NPH insulin - 30 Units, once daily at bedtime – Fast acting analogue - 60 Units/day: – 22 units at breakfast – 18 units at lunch – 20 units at dinner – Metformin 2000 mg, once per day • Comorbid diseases: – Non-proliferative retinopathy – diabetic peripheral polyneuropathy – polygenic hypercholesterolaemia – non-alcoholic hepatic impairment – arterial hypertension, ischemic heart disease. • Other medications taken: • Ramipril, indapamide, lercanidipine, rosuvastatin, acetylsalicylic acid, alpha-lipoic acid

Case study 3: AGP Report

AGP Report

3 April 2021 - 16 April 2021 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

3 April 2021 - 16 April 2021

14 Days

% Time Sensor is Active

88%

Ranges And Targets For Type 1 or Type 2 Diabetes

Glucose Ranges	Targets % of Readings (Time/Day)
Target Range 70-180 mg/dL	Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Below 180 mg/dL	Less than 25% (6h)
Below 250 mg/dL	Less than 5% (1h 12min)

Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.

Average Glucose

156 mg/dL

Glucose Management Indicator (GMI)

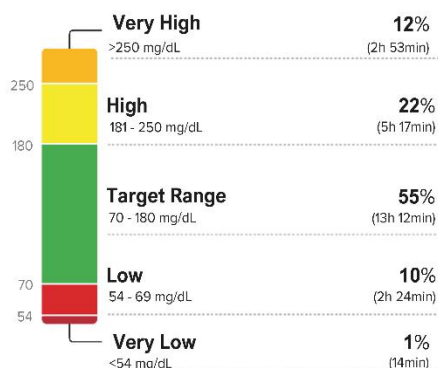
7.0% or 54 mmol/mol

Glucose Variability

46.2%

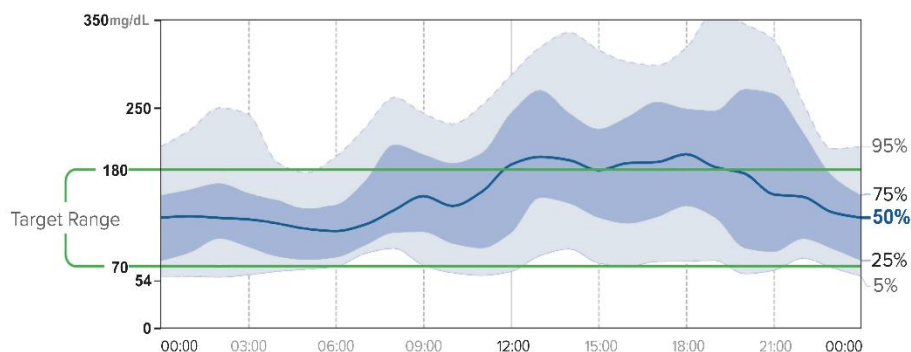
Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES



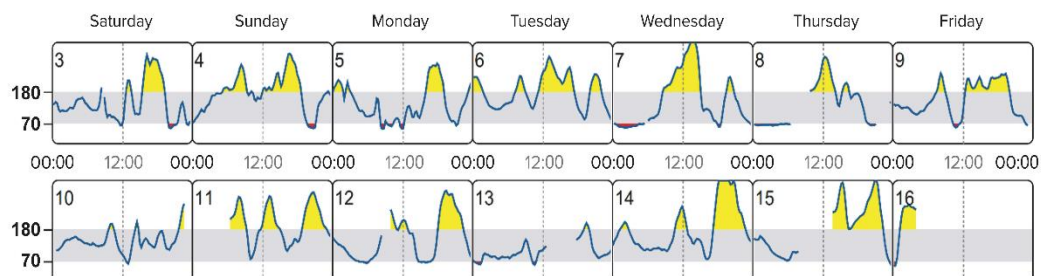
AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



DAILY GLUCOSE PROFILES

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Case study 3: Interpretation and recommendations

ISSUE:	
Quality of data captured by the CGM system	88% sensor active time, 14-day analysis period Sufficient for adequate assessment of glycaemic control indices
Percentage of time in each target range	Not compliant with the targets for this patient group TIR = 55%; TAR 181-250 mg/dL = 22%; TAR > 250 mg/dL = 12%; TBR 54-69 = 10%; TBR < 54 mg/dL = 1% Too much time spent in hypoglycaemia and too much time spent in hyperglycaemia > 250 mg/dL
Glycaemic data	Mean glucose = 156 mg/dL; GMI = 7.0%; both are optimal
Glycaemic variability	High glycaemic variability (CV 46.2% versus target $\leq 36\%$)
IDENTIFY CLINICAL PROBLEM AND OFFER SOLUTION TO PATIENT	
Hypoglycaemia	Episodes of hypoglycaemia at different times of the day and night.
High glycaemic variability	Overall variability of glycaemia is too high. Glucose variability in the afternoon and evening is much higher than in the morning and at night.
Hyperglycaemia	Glucose readings are in the target range for most of the time, but for a significant part of the day, especially in the afternoon and evening, the glucose levels are too high.
RECOMMENDATIONS/COMMENTS: TIR 55% is within the therapeutic target. The recommended value for older people with advanced diabetes complications (cardiovascular disease) is 50%. The main problem is the significant glycaemic variability with CV of 46.2% compared to a recommended level of $\leq 36\%$. Such high glycaemic variability correlates with a high risk of hypoglycaemia and a significant hyperglycaemia. TBR <70 mg/dL and TBR <54 mg/dL are respectively 11% and 1%, whereas the recommended percentage of time in hypoglycaemia <70 mg/dL is 1%. In older and high-risk patients, the percentage of time in hyperglycaemia >250 mg/dL should not exceed 10%, whereas this patient is at 12%. For this patient, insulin therapy is used in combination with metformin. However, the patient only performs an average of 6 scans/day. The patient was offered a switch from NPH insulin to a long-acting insulin analogue and an SGLT2 inhibitor was added to the treatment. The dose of basal insulin was reduced. The possible causes	

of increased glycaemic variability during the evening and his hypoglycaemic episodes were discussed (physical activity, diet, rules for adjusting insulin dose). The patient was encouraged to perform more scans per day.

For a patient at very high cardiovascular risk, his high risk of severe hypoglycaemia and the use of a CGM system provides a greater sense of security in modifying treatment. In this case, the priority should be to reduce glycaemic variability, to reduce hypoglycaemic episodes as much as possible and reduce hyperglycaemic episodes >250 mg/dL.

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Case study 4: Patient profile

Patient 4	Current diabetes therapy
Age: 32 years Gender: Female Type of diabetes: Gestational diabetes (GDM2) Duration of diabetes: 13 weeks (from the 9th week of pregnancy) BMI before pregnancy: 34.0 kg/m ² Last HbA1c score: Not determined	Current diabetes therapy • Diabetes diet, from 13 weeks • Intensive insulin therapy – Fast-acting and long-acting analogue, recommended after 3 days of scanning with the FreeStyle Libre system, from the 21st week of pregnancy. • Comorbid diseases: – Primary hypothyroidism • Other medications taken: – L-thyroxin

Case study 4: AGP Report

AGP Report

14 April 2020 - 27 April 2020 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

14 April 2020 - 27 April 2020

14 Days

% Time Sensor is Active

93%

Ranges And Targets For		Type 1 or Type 2 Diabetes
Glucose Ranges	Targets	% of Readings (Time/Day)
Target Range 70-180 mg/dL	Greater than 70%	(16h 48min)
Below 70 mg/dL	Less than 4%	(58min)
Below 54 mg/dL	Less than 1%	(14min)
Below 180 mg/dL	Less than 25%	(6h)
Below 250 mg/dL	Less than 5%	(1h 12min)

Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.

Average Glucose

108 mg/dL

Glucose Management Indicator (GMI)

5.9% or 41 mmol/mol

Glucose Variability

17.4%

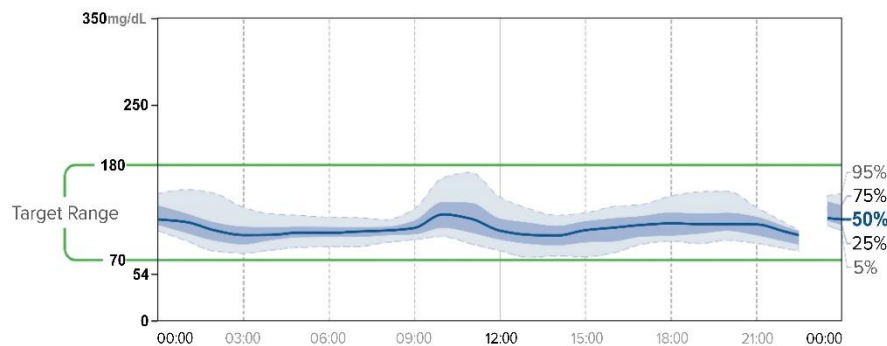
Defined as percent coefficient of variation (%CV); target $\leq 36\%$

TIME IN RANGES



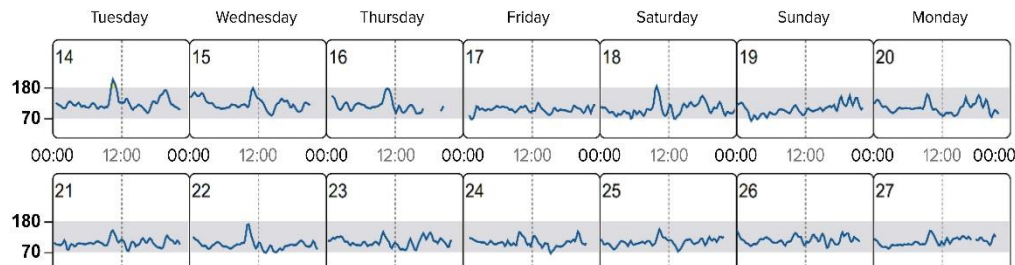
AMBULATORY GLUCOSE PROFILE (AGP)

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DAILY GLUCOSE PROFILES

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Case study 4: Interpretation and recommendations

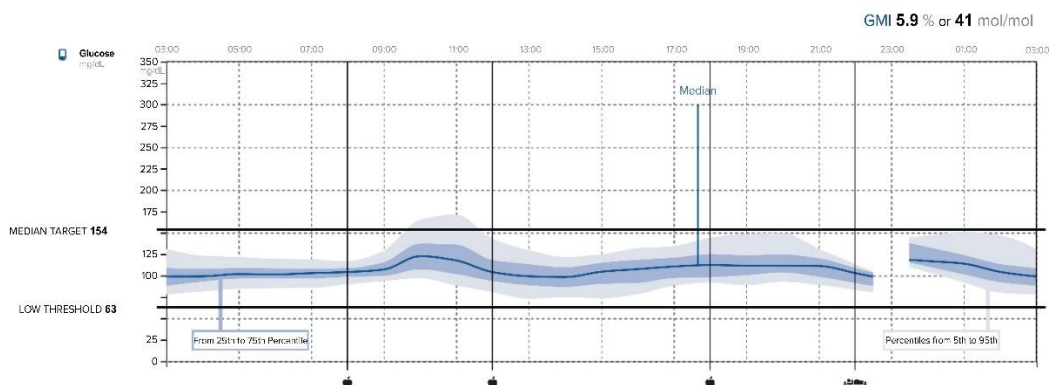
ISSUE:	
Quality of data captured by the CGM system	93% sensor active time, 14-day analysis period Sufficient to adequately assess glycaemic control indices
Percentage of time in each target range	Recommended TIR for women with gestational diabetes is 90% in glucose range 63-140 mg/dL Note: in the AGP report the TIR is generated for the default range of 70-180 mg/dL, it is necessary to set the range and evaluate the details of the other reports available in LibreView (see below).
Glycaemic data	Mean glucose = 108 mg/dL; GMI = 5.9%
Glycaemic variability	Normal value (CV 17.4% versus target $\leq 36\%$)

IDENTIFY CLINICAL PROBLEM AND OFFER SOLUTION TO PATIENT

Daily Patterns

14 April 2020 - 27 April 2020 (14 Days)

LibreView

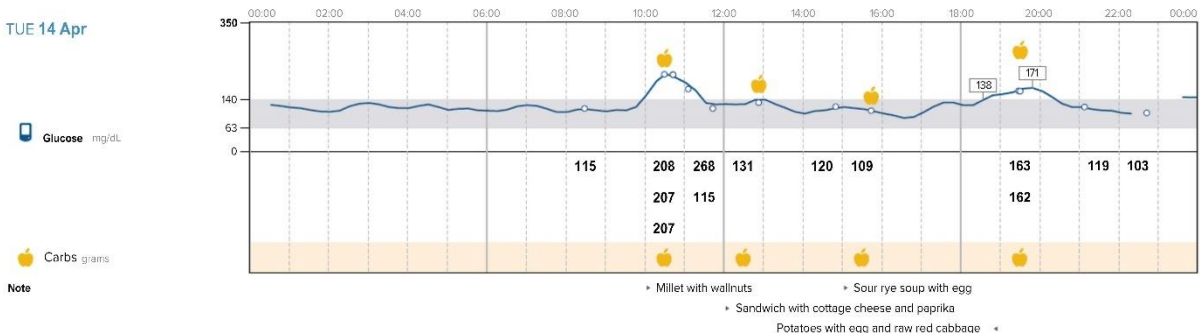


Daily Log

14 April 2020 - 27 April 2020 (14 Days)

LibreView

TUE 14 Apr



Weekly Summary

14 April 2020 - 27 April 2020 (14 Days)

LibreView



Hypoglycaemia

No episodes of hypoglycaemia were observed.

High glycaemic variability

Glycaemic variability is below target.

Hyperglycaemia

Post-meal hyperglycaemia around 10.00 a.m. on consecutive days

RECOMMENDATIONS/COMMENTS:

In gestational diabetes, dietary treatment as well as insulin therapy require detailed analysis of glycaemic data. Glycaemic disturbances are often not so pronounced but have a significant impact on the environment in which the foetus develops, hence the recommended glycaemic ranges and TIR targets for pregnancy. Both the qualitative composition, timing, the portion size, CHO in the meals during the day influence the glycaemia during pregnancy and, given the dynamics of the pregnancy, therapeutic decisions should be taken quickly.

Due to the physiology of the pregnancy and the specific nature of GDM, there is a low risk of hypoglycaemia, especially during night-time hours. Pay attention to the timing and composition of the last meal and the dose of night insulin, if used. During pregnancy, 6 meals are recommended: every 2.5 to 3 hours during the day and the late meal should not be taken after 10.00 p.m. One of the most important risk factors for macrosomia and metabolic disorders in the foetus is high glycaemic variability. Large glycaemic fluctuations are most often observed in pregnant women who eat only 3-4 meals.

It is worth noting that, in addition to the obvious diagnostic aspect, CGM systems are an excellent educational tool to facilitate the observation of glycaemic effects of meals consumed and insulin doses administered, as well as physical activity.

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